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Attorney's Docket No. NC 13957

Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Kenneth McClure

WARNING: Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR 1.41(a) and 1.53(b).

For (title): Scanning Guard Timer

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date, 4/12/99, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EJ572257486US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Beverly Meredith
(type or print name of person mailing paper)

Beverly Meredith
Signature of person mailing paper

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.10(b).

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED** and a **NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION**.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35. U.S.C. 119(e), 120, or 121)

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). [35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).] For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

WARNING: When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

☒ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**.

3. Papers Enclosed That Are Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

 22 Pages of specification

 8 Pages of claims

 1 Page of Abstract

 6 Sheets of drawing

☐ formal

☒ informal

WARNING: *DO NOT* submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

4. Additional papers enclosed

- ☐ Preliminary Amendment
- ☒ Information Disclosure Statement (37 C.F.R. 1.98)
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath

- ☒ Enclosed
- Executed by

(check all applicable boxes)

- ☒ inventor(s).
- ☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

- ☐ Not Enclosed.

WARNING: Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of **all** the above named inventor(s).

[The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently.]

NOTE: *It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).*

- ☐ Showing that the filing is authorized.
[not required unless called in question. 37 CFR 1.41(d)]

6. Inventorship Statement

WARNING: *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application are:

- ☒ The same.

or

- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,
☐ is submitted.
☐ will be submitted.

7. Language

NOTE: *An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).*

NOTE: *A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).*

- ☒ English
☐ Non-English
☐ The attached translation is a verified translation. 37 CFR 1.52(d).

8. Assignment

- ☒ An assignment of the invention to Nokia Mobile Phones OY
☒ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.
☐ will follow.

NOTE: *"If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).*

WARNING: *A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.*

9. Certified Copy

Certified copy(ies) of application(s)

| Country | Appln. no. | Filed |
|---------|------------|-------|
|---------|------------|-------|

| Country | Appln. no. | Filed |
|---------|------------|-------|
|---------|------------|-------|

| Country | Appln. no. | Filed |
|---------|------------|-------|
|---------|------------|-------|

from which priority is claimed

☐ is (are) attached.

☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. 1.16)

A. ☒ Regular application

| CLAIMS AS FILED | | | |
|-------------------------------------|--------------|------------|-------------------|
| Number Filed | Number Extra | Rate | Basic Fee |
| | | | 37 C.F.R. 1.16(a) |
| | | | \$760.00 |
| Total Claims | | | |
| 31-20 = 11 | 11 | x \$18.00 | 198.00 |
| Independent Claims | | | |
| 4-3 = 1 | 1 | x \$78.00 | 78.00 |
| Multiple dependent claim(s), if any | | | |
| | 0 | + \$260.00 | -0- |

☐ Amendment cancelling extra claims is enclosed.

☐ Amendment deleting multiple-dependencies is enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation

\$1036.00

- B. ☐ Design application
[\$310.00—37 CFR 1.16(f)]

Filing Fee Calculation \$

- C. ☐ Plant application
[\$480.00—37 CFR 1.16(g)]

Filing Fee Calculation \$

11. Small Entity Statement(s)

- ☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

WARNING: *Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired." 37 C.F.R. § 1.28(a)

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application.
_____/_____, was filed on _____, from which
benefit is being claimed for this application under:

35 U.S.C. ☐ 119(e),

☐ 120,

☐ 121,

☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the verified statement in the prior application is included. Filing
Fee Calculation (50% of A, B or C above) \$ _____

NOTE: Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendible under § 1.136, 37 CFR 1.28(a).

12. Request for International-Type Search [37 C.F.R. 1.104(d)]

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently).

☒ Enclosed

☒ Filing fee \$1036.00

☐ Recording assignment _____
[\$40.00; 37 C.F.R. 1.21(h)]
(See attached "COVER SHEET FOR ASSIGNMENT
ACCOMPANYING NEW APPLICATION").

☐ Petition fee for filing by other than all the inventors or
person on behalf of the inventor where inventor refused
to sign or cannot be reached _____
[\$130.00; 37 C.F.R. 1.47 and 1.17(h)]

☐ For processing an application with a specification
in a non-English language _____
[\$130.00; 37 C.F.R. 1.52(d) and 1.17(k)]

☐ Processing and retention fee _____
[\$130.00; 37 C.F.R. 1.53(d) and 1.21(l)]

☐ Fee for international-type search report _____
[\$40.00; 37 C.F.R. 1.21(e)]

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicates that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(d).

Total fees enclosed \$1036.00

14. Method of Payment of Fees

☐ Check in the amount of \$ _____

☒ Charge Account No. 50-0270 in the amount of \$1036.00

Two duplicates of this transmittal are attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 50-0270.

☒ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: *Because additional fee for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency [37 CFR 1.16(d)], it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.*

☒ 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. 1.17 (application processing fees)

WARNING: While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added) Notice of November 5, 1985 (1060 O.G. 27)

☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: *Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).*

NOTE: *37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application...prior to paying, or at the time of paying,...issue fee." From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.*

16. Instructions as to Overpayment

☒ Credit Account No. 50-0270.

☐ Refund

Reg. No. 41,270

Tel. No. (972) 894-4959



Signature of Attorney

Brian T. Rivers

(type or print name of attorney)

Nokia Mobile Phones, Ltd.

6000 Connection Drive
(P.O. Address)

Irving, TX 75039

☐ **Incorporation by reference of added pages**

[check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an International Application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.]

- ☒ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added 1

- ☐ Plus Added Pages for Paper Referred to in Item 4 Above

Number of pages added _____

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☐ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this transmittal with this page and check the following item)

- ☐ This transmittal ends with this page.

Scanning Guard Timer

Cross-Reference to Related Application

5 This application claims priority from Provisional Application Serial
No.: _____ filed 30 March 1999 (Attorney's Docket No.: NC-13957P),
which is hereby incorporated by reference.

Field of the Invention

10 This invention relates to background scanning for a more preferred
system in mobile communications systems, and particularly to elimination
of missed pages during such background scanning.

Background of the Invention

15 In a TDMA cellular radiotelephone system, each radio channel is
divided into a series of time slots, each of which contains a burst of
information from a data source, e.g., a digitally encoded portion of a voice
conversation. The time slots are grouped into successive TDMA frames
having a predetermined duration. The number of time slots in each TDMA
20 frame is related to the number of different users that can simultaneously
share the radio channel. If each slot in a TDMA frame is assigned to a
different user, the duration of a TDMA frame is the minimum amount of
time between successive time slots assigned to the same user. The
successive time slots assigned to the same user, which are usually not
consecutive time slots on the radio carrier, constitute the user's digital traffic
25 channel (or DTC), which may be considered a logical channel assigned to

the user. As described in more detail below, digital control channels (DCCs) can also be provided for communicating control signals, and such a DCC is a logical channel formed by a succession of usually non-consecutive time slots on the radio carrier.

5 In North America, these features are currently provided by a digital cellular radio telephone system called the digital advanced mobile phone service (D-AMPS), some of the characteristics of which are specified in the interim standard IS-54B, "Dual-Mode Mobile Station-Base Station Compatibility Standard", published by the Electronic Industries Association and Telecommunications Industry Association (EIA/TIA). Interim Standard (IS) 136 (promulgated by the Telecommunications Industry Association) adds a Digital Control Channel (DCCH) to IS-54B. References to IS-54B in this document are meant to incorporate IS-136.

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15
20
25 According to IS-54B, each TDMA frame consists of six consecutive time slots and has a duration of 40 milliseconds (ms). Thus, each radio channel can carry from three to six DTCs (e.g., three to six telephone conversations) depending on the source rates of the speech coder/decoders (codecs) used to digitally encode the conversations. Such speech codecs can operate at either full-rate or half-rate, with full-rate codecs being expected to be used until half-rate codecs that produce acceptable speech quality are developed. The TDMA cellular system operates in a buffer-and-burst, or discontinuous-transmission, mode: each mobile station transmits (and receives) only during its assigned time slots. At full rate, for example, a mobile station might transmit during slot 1, receive during slot 2, idle during slot 3, transmit during slot 4, receive during slot 5, and idle during

slot 6, and then repeat the cycle during succeeding TDMA frames. Therefore, the mobile station, which may be battery-powered, can be switched off, or sleep, to save power during the time slots when it is neither transmitting nor receiving. In the IS-54B system in which the mobile does not transmit and receive simultaneously, a mobile can sleep for periods of at most about 27 ms (four slots) for a half-rate DTC and about 7 ms (one slot) for a full-rate DTC.

Note that the term mobile station is used herein to refer to a radio unit in a communications system, which includes radio units that are "stationary" or "fixed", and is not limited to being "mobile." The term "mobile" unit is used herein merely because of its wide acceptance and clear meaning in the communications arts.

In addition to voice or traffic channels, cellular radiocommunication systems also provide paging access, or control, channels for carrying call-setup messages between base stations and mobile stations

In general, the transmission rate of the DCC need not coincide with the half-rate and full-rate specified in IS-54B, and the length of the DCC slots may not be uniform and may not coincide with the length of the DTC slots. The DCC may be defined on an IS-54B radio channel and may consist, for example, of every n-th slot in the stream of consecutive TDMA slots. In this case, the length of each DCC slot may or may not be equal to 6.67 ms, which is the length of a DTC slot according to IS-54B. Alternatively (and without limitation on other possible alternatives), these DCC slots may be defined in other ways known to one skilled in the art.

Figure 1 shows a general example of a forward DCC configured as a succession of time slots 1, 2, . . . , N, . . . belonging to a particular DCC. These DCC slots may be defined on a radio channel such as that specified by IS-54B, and may consist, for example, of every n-th slot in a series of N consecutive slots. The DCC slots shown in Figure 1 are organized into superframes (SF)', and each superframe includes a number of logical channels that carry different kinds of information. One or more DCC slots may be allocated to each logical channel in the superframe.

Of the slots in a Superframe available for signaling, some are designated by the base station (BMI) for broadcast (point-to-multipoint) messaging and the rest for point-to-point messaging. In order for the base station to be able to notify (or "page") a mobile station (MS) of an incoming call (or other impending transaction), the mobile station is assigned to one and only one of the slots in a Superframe available for point-to-point messaging on the forward DCC (i.e., that portion of the DCC used to transmit messages from the base station to the mobile station).

As used herein, the terms "page" and "page message" refer to one or more slots of data transmitted from a base station over the point-to-point messaging channel that contains information intended to signal one (or possibly more) of a plurality of mobile stations that such mobile stations have an incoming call. (An incoming call can be, for example, a voice call or any other type of incoming call capable of being serviced by the base station and mobile stations.) The term "non-page message" refers to any slots of data transmitted over the point-to-point messaging channel that are not "page messages".

Figure 1 also shows an exemplary downlink superframe, which includes at least three logical channels: a broadcast control channel (BCCH) including six successive slots for overhead messages; a paging channel (PCH) including one slot for paging messages; and an access response channel (ARCH) including one slot for channel assignment and other messages. The remaining time slots in the exemplary superframe of Figure 1 may be dedicated to other logical channels, such as additional paging channels or other channels. Since the number of mobile stations is usually much greater than the number of slots in the superframe, each paging slot is used for paging several mobile stations that share some unique characteristic, for example, the last digit of the MIN.

Although IS-54B provides for digital traffic channels, more flexibility is desirable in using digital control channels having expanded functionality to optimize system capacity and to support hierarchical cell structures, i.e., structures of macrocells, microcells, picocells, etc. The term "macrocell" generally refers to a cell having a size comparable to the sizes of cells in a conventional cellular telephone system (e.g., a radius of at least about 1 kilometer), and the terms "microcell" and "picocell" generally refer to progressively smaller cells. For example, a microcell might cover a public indoor or outdoor area, such as a convention center or a busy street, and a picocell might cover an office corridor or a floor of a high-rise building.

From a radio coverage perspective, macrocells, microcells, and picocells may be distinct from one another or may overlap one another to handle different traffic patterns or radio environments. Each of these types of cells has a base station which transmits at least one control channel.

Thus, a number of neighboring control channels are present for a mobile or remote unit to evaluate as a possible replacement for the current serving control channel to which it is locked.

Accordingly, DCCs will be periodically evaluated by the mobile station for possible control channel reselection. For example, when in an idle state i.e., switched on but not making or receiving a call, a mobile station in an IS-54B system tunes to and then regularly monitors the strongest control channel (generally, the control channel of the cell in which the mobile station is located at that moment) and may receive or initiate a call through the corresponding base station. Re-tuning is required when the mobile station receives signals from the serving base station (registered station) at such a degraded level that the mobile station is forced to tune to a control channel of a nearby alternative base station.

The initial tuning and subsequent re-tuning to control channels are both accomplished automatically by scanning all the available control channels at their known frequencies to find the best control channel. The terms scan or scanning as used in this document, can refer to, for example, signal strength measurement, actual signal decoding, or any other method of evaluating a signal.

When a control channel with good reception quality is found, the mobile station remains tuned to this channel until the quality deteriorates again. In this way, mobile stations are relatively continuously in communication with the cellular system.

According to a more recent innovation in cell reselection disclosed in U.S. Pat. No. 5,353,332 to Raith and Muller, each control channel in each

cell is configured to broadcast information, including system parameters, about the presence, if any, of other cells and the characteristics of those cells including minimum quality criteria, power requirements, etc. Typically, information about the presence of other cells is broadcast about neighboring cells. For instance, a neighboring cell may be adjacent to, overlapping, or non-contiguous from the broadcasting cell.

A mobile periodically scans, during idle mode, the neighboring control channels in the coverage area that the mobile is located in to determine in which cell it should be locked (or registered). This process is known as background scanning. Each control channel includes a neighbor list. The neighbor list identifies other control channels which mobiles locked to that control channel should periodically evaluate. Thus, a mobile may continuously select cells to be locked to based on the existing location of the mobile and quality criteria, such as received signal strength, associated with the cells. The cell to which the mobile may be locked is the cell in which the mobile satisfies the quality criteria associated with the cell.

While in the idle state, and in addition to evaluating control channels as potential reselection candidates, a mobile station must monitor the control channel for paging messages addressed to it. When the base station needs to "page" the mobile station, that is, notify the mobile station that it has an incoming call (or other impending transaction), the base station transmits a "page message" or a "hard page" in the assigned slot for the mobile station. Under quiescent conditions, the mobile station need only monitor this assigned slot in the Superframe. Thus, the mobile station is able

to "sleep" while the other 31 slots of the Superframe are being transmitted. In addition, because every other Superframe transmitted (i.e., every primary Superframe) by the base station is followed by a Superframe (secondary Superframe) having identical point-to-point paging slots, the mobile unit can sleep during every other entire Superframe. For other types of point-to-point traffic, however, the mobile station is not assigned to a specific slot in a Superframe; rather, when it is expecting a "non-page message," i.e., not a message intended to notify the mobile station of an incoming call (or other impending transaction), from the base station, the mobile station is required to search for non-page messages addressed to itself in each slot available for point-to-point messaging within the Superframe.

Currently, mobile stations are hashed to a slot in the Superframe (called a PCH Subchannel) where the mobile station expects to receive page traffic. Nominally, the mobile station is required to read this same slot in every other Superframe.

Figure 2 depicts a block diagram of the various elements in a time division multiple access digital control channel. A TDMA Frame **200** is depicted which is made up of six slots **202, 204, 206, 208, 210, 212**. Each slot 202, 204, 206, 208, 210, 212 is transmitted through the communications channel, consisting primarily of air, during a 6.67 ms period of time, such that the TDMA Frame 200 is 40 ms in duration. In accordance with current TDMA conventions, a TDMA channel is made up of every third slot within the TDMA Frame. Thus, slots 1 and 4 (202, 208) are a part of one TDMA

channel, slots 2 and 5 (204, 210) part of another TDMA channel, and slots 3 and 6 (206, 212) yet another.

Within each TDMA channel, groups of 32 TDMA blocks (and thus 32 slots) comprise a Superframe **214**, having a duration of 640 ms. A total of three Superframes, one per TDMA channel, is transmitted every 640 ms. Within each Superframe 214, a portion of the slots is designated as the Broadcast Channel (BCCH), another portion Reserved, and another portion the point-to-point messaging channel. Each mobile unit monitoring a particular base station is assigned to monitor a particular PCH subchannel, i.e., a particular slot within the point-to-point messaging channel.

As an example, slot 24 (**216**) may be the monitored PCH subchannel for a particular group of mobile units within a cell (assuming for a given case slot 24 is part of the point-to-point messaging channel). The PCH subchannel may contain any of a plurality of point-to-point communications encoded in 324 bits, which make up the PCH subchannel.

The mobile unit, is not always monitoring the digital control channel (DCCH) for Page Messages. Each slot in a given digital control channel has a specified function (in accordance with IS-136). Some, called broadcast control channel (BCCH) slots, are allocated to carry overhead information to all mobile stations that may be monitoring a particular digital control channel (point-to-many). Others, called Short Message Service, Paging, and Access Response Channel (SPACH) slots, are used by the base station to carry point-to-point Messages to a specific mobile station. Together the BCCH and the SPACH (as possibly some Reserved slots) comprise a

Superframe. Each Superframe is made up of a total of thirty-two slots (in a full-rate DCCH), each allocated as a BCCH slot or a SPACH slot (or possibly a Reserved slot). Superframes are transmitted in pairs referred to as Primary and Secondary Superframes, respectively. In a quiescent system, the mobile station is only required to monitor a single SPACH slot (called its Paging Channel (PCH) Subchannel) in every other Superframe, i.e., in every Primary Superframe.

In digital cellular systems, there are several standards requiring the mobile station to search for a system while registered on another (background scanning). This search takes place on the mobile station without any assistance from the base station (as in reselection or handoff). Furthermore, this search takes place without any coordination between the mobile station and the base station.

There are currently several specifications requiring this type of background scanning. For example, Intelligent Roaming for ANSI 136 utilizes a database to determine the priority of a system. While registered on certain low priority systems, the mobile station must search for a system of higher priority.

Another example of a specification requiring background scanning is the Inter-Network Roaming Selection specification from GSM North America (GSM NA). This specification requires a priority database to determine the best system in AMPS and GSM 1900. While registered to a low priority system, the mobile station must search another protocol for a higher priority system. The ANSI-136 Intelligent Roaming and Inter-

Network Roaming Selection specifications are the first of many specifications dealing with prioritized system selection requiring background scanning.

5 The drawback of background scanning, however, is that, during the period of time the mobile station is retrieving identification parameters from the base system under investigation (or evaluation) as a possibly better system, the mobile station can miss pages on the system to which it is registered. This aspect of the background scanning is addressed in the Intelligent Roaming specification by forcing the base station to repeat a missed page after five seconds. This gives a mobile station in the TDMA/AMPS environment a second chance to receive the page.

10 The GSM NA specification does not address this possibility of missed pages. Therefore, a mobile station conforming to the GS NA standard can fatally miss a page if the unrepeatd page goes undetected by the mobile station.

Summary of the Invention

15 The present invention discloses a method and system of background scanning of a base system under evaluation by a mobile station without missing pages on the registered system. The registered system is defined as the system in which the mobile station has registered and will receive pages. The system under evaluation is the system from which the mobile station must retrieve system parameters (the possibly higher priority system). The various disclosed embodiments use the periodicity of the paging information to set a guard timer that will force the mobile station back to the

registered system before the paging information in the next time slot is missed. After receiving the paging information, the mobile station can continue its search and evaluation of base systems. In other words, the guard timer breaks the background scan into smaller segments that are performed between retrievals of paging information.

One or more of the disclosed embodiments provides at least the following advantages:

Ability to operate in a dual-mode (or greater) environment without regard to particular paging protocols.

Reduction in missed pages occurring during base system evaluation;

Reduced traffic on paging channels by eliminating the need to force a base station to repeat a page after 5 seconds of no response; and

Faster mobile station responses to base system paging.

In an embodiment of the invention, a mobile station receives its paging frame from the base station on which it is currently registered. Receipt of the paging frame triggers a scanning guard timer timing sequence. During the timing sequence, the mobile station scans and evaluates an other base station. At the end of the timing sequence, the scanning guard timer forces the mobile station to stop scanning and switch back to the registered station to receive the next paging frame from the registered base station.

Brief Description of the Drawings

The disclosed inventions will be described with reference to the accompanying drawings, which show important sample embodiments of the invention and which are incorporated in the specification hereof by reference, wherein:

Figure 1 shows a general example of a forward DCC configured as a succession of time slots 1, 2, . . . , N, . . . belonging to a particular DCC.

Figure 2 depicts a block diagram of the various elements in a time division multiple access digital control channel.

Figure 3 depicts expiration of the guard timer prior to receiving system parameters.

Figure 4 depicts a block diagram of a cellular communications system suitable for implementing the disclosed embodiments.

Figure 5 depicts the guard timer being halted after receiving system parameters.

Figure 6 depicts a block diagram of a mobile station that can make use of the disclosed embodiments.

Detailed Description of the Preferred Embodiments

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred embodiment. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses of the innovative teachings herein.

The guard timer provides a method to return to a mobile station to a registered system from a background scan (on a system under evaluation) so that no paging frame is missed. The guard timer is a control program loaded and executed by the mobile station immediately after the it receives the paging frame (slot, or equivalent) that is responsible for containing any paging information for the mobile station. The guard timer is set to expire after a controlled time period allowing the mobile to receive the next paging frame (or equivalent) that is responsible for containing any paging information for the mobile station.

Figure 3 depicts expiration of the guard timer prior to receiving system parameters. After receiving a paging frame, the mobile station starts the guard timer at time hash **304**. A system specific delay (represented by *A*) denotes the delay time, if any, in the mobile station that occurs between receiving of the paging frame and starting the guard timer. Such system specific delays can include, for example, software and hardware execution delays, task switching, and other system functions that delay the mobile station in switching its receiver to process the alternative

frequency of the evaluated system. Such delays are system (hardware and software) dependent, differing depending on mobile station architecture. Other delays can include, for example, delays due to the physical movement of the mobile station in between paging frames or other ambiguities in the distance of the mobile station from the base station due to the movement of the mobile station. In the example depicted in Figure 3, system parameters for the evaluated system are being transmitted in frame 302. Before any system parameters are received from the base system being evaluated, the guard timer expires at time hash 306. The mobile station, then begins to switch from monitoring the evaluated system to monitoring the registered system. A second system specific delay (represented by *B*) denotes the delay time, if any, in the mobile station that occurs between the expiration of the guard timer 306 and the switch of the mobile receiver from the evaluated system back to the registered system, at time hash 308. Again, such system specific delays can include, for example, software and hardware execution delays, task switching, and other system functions that delay the mobile station in switching its receiver to process the alternative frequency of the evaluated system. Such delays are system (hardware and software) dependent, differing depending on mobile station architecture. The system specific delay (represented by *C*) denotes the delay time, if any, required by the mobile station in switching back to the registered system and the time when the mobile station is capable of successfully processing a paging frame (synchronization time). Such system specific delays can include, for example, software and hardware execution delays, task switching, and other system functions that delay the mobile station in switching its receiver to

process the alternative frequency of the evaluated system. Such delays are system (hardware and software) dependent, differing depending on mobile station architecture. Since the parameters 302 were not received, the mobile station will repeat this process again after processing the paging frame.

5 In the presently preferred embodiment, the period for the guard timer must take into account the delays mentioned above (*A*, *B*, and *C*). The guard timer should be set no greater than the sum of these delays subtracted from the period of time between paging frames or between same numbered frames in a superframe.

10 **Figure 5** depicts the guard timer being halted after receiving system parameters. In Figure 5, after receiving the paging frame, the mobile station starts the guard timer. The mobile station receives the system parameters 302 from the evaluated system before the expiration of the guard timer. The guard timer is halted, at time hash 310, and the mobile station switches back to the registered system (after *C* delays) with ample time to receive the next paging frame.

15 **Figure 4** depicts a block diagram of a cellular communications system suitable for implementing the disclosed embodiments. A cellular telephone system 10 has a plurality of mobile switching centers (MSC) 12, 14, 16, or mobile telephone switching offices (MTSO), that are connected to each other and to a public switched telephone network (PSTN) 18. Each of the mobile switching centers is connected to a respective group of base station controllers (BSC) 20, 22, 24. Each base station controller is
20 connected to a group of individual base transceiver stations (BTS) 26, 28,
25

30. Each base transceiver station of the groups 26, 28, 30 defines an individual cell of the cellular telephone system.

Each base transceiver station of the groups 26, 28, 30 includes hardware and software functions required to communicate over communications channels of the system 10; and includes transmitters and receivers for communication with mobile telephone units. Each base transceiver station 26, 28, 30 also includes a plurality of individual standard receivers (StdR) 31 and scanning receivers (SR) 32 for scanning selected portions of the communications channel. Each base transceiver station 26, 28, 30 further includes digital multiplex equipment for transmission of audio traffic to its associated base station controller. It is the base transceiver stations 26, 28, 30, along with their associated base station controllers 20, 22, 24 and mobile switching centers, that perform the steps described herein in order to carry out one embodiment of the invention.

A plurality of digital mobile stations 33 is used with the system 10 for communication over the communications channel (or radio frequency traffic channel) with a particular base transceiver station of a particular cell in which the particular base transceiver station is located. According to the various disclosed embodiments, associated with each digital mobile station 33 is a scanning receiver 35 for scanning selected portions of the communications channel between the mobile unit 33 and the base transceiver station of serving and neighboring cells.

Each base station controller of the groups 20, 22, 24 implements audio compression/decompression, handles call establishment, disconnect, and handoff procedures, and allocates system resources between the

individual base transceiver stations 26, 28, 30 associated with each of the base station controllers 20, 22, 24. More specifically, each base station controller performs handoff execution for transferring on-going communications from one cell to another within the group of base transceiver stations connected to the particular base station controller. Each base station controller communicates with its associated mobile switching center for effecting a handoff involving a cell or base transceiver station associated with a different base station controller. Each mobile switching center 12, 14, 16 processes all requests for calls, switching functions, as well as the mobility functions of registration, authentication and handoff.

Figure 6 depicts a block diagram of a mobile station **600** that can make use of the disclosed embodiments (like 33 and 35 described in Figure 4). The mobile station 600 includes, in this example:

A control head **602** containing an audio interface, i.e. a speaker **604** and microphone **606**. The control head 602 generally includes a display assembly **608** allowing a user to see dialed digits, stored information, messages, calling status information, including signal strength, etc. The control head generally includes a keypad **610**, or other user control device, allowing a user to dial numbers, answer incoming calls, enter stored information, and perform other mobile station functions. The control head also has a controller unit **634** that interfaces with a logic control assembly **618** responsible, from the control unit perspective, for receiving commands from the keypad 610 or other control devices, and providing status information, alerts, and other information to the display assembly 608;

5 A transceiver unit **612** containing a transmitter unit **614**, receiver unit **616**, and the logic control assembly **618**. The transmitter **614** converts low-level audio signals from the microphone **606** to digital coding using a codec (a data coder/decoder) **620**. The digitally encoded audio is represented by modulated shifts, for example, in the frequency domain, using a shift key modulator/demodulator **622**. Other codes transmission utilized by the logic control assembly **618**, such as station parameters and control information, may also be encoded for transmission. The modulated signal is then amplified **624** and transmitted via an antenna assembly **626**;

10 The antenna assembly **626** contains a TR (transmitter/receiver) switch **636**. The TR switch **636** is used to prevent simultaneous reception and transmission of a signal by the mobile station **600**. The antenna assembly also contains at least one antenna **638**. Optionally, a different antenna may be coupled **640** to the antenna assembly.

15 A receiver unit which receives a transmitted signal via the antenna assembly **626**. The signal is amplified **624** and demodulated **622**. If the signal is an audio signal, it is decoded using the codec **620**. The audio signal is then reproduced by the speaker **604**. Other signals are handled by the logic control assembly **618** after demodulation **622**; and

20 A logic control assembly **618** usually containing an application specific integrated circuit (or ASIC) combining many functions, such as a general purpose microprocessor, digital signal processor, and other functions, into one integrated circuit. The logic control assembly **618** coordinates the overall operation of the transmitter and receiver using control messages. The various disclosed embodiments make use of the

25

logic control assembly to control scanning and evaluation of other base stations. Generally, the logic control assembly operates from a program that is stored in flash memory 628 of the mobile station. Flash memory 628 allows upgrading of operating software, software correction or addition of new features. Flash memory 628 is also used to hold user information such as speed dialing names and stored numbers. The various disclosed embodiments typically function from this or another section of the mobile station's memory.

In addition to flash memory 628, the mobile station will typically contain read only memory (ROM) 630 for storing information that should not change, such as startup procedures, and random access memory (RAM) 632 to hold temporary information such as channel number and system identifier.

In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others. As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a tremendous range of applications, and accordingly the scope of patented subject matter is not limited by any of the specific exemplary teachings given.

For example, other wireless telecommunications standards, currently in existence or which may be created, may require different responses and evaluations of neighboring base systems. In turn, the guard timer or

evaluation duration may need to be lengthened or shortened. Further, differing frame patterns or timing alterations may require changes in the guard timer.

As processor times increase and system specific delays decrease, it may become possible to evaluate more than one other base station between the paging frames of a registered base station. In such a case, modifications to the guard timer incorporating re-tuning to several frequencies and other delays may have to be incorporated.

As described above, mobile station architecture can affect the A , B , and C delay times. It is possible that some architectures may reduce one or more of these times to effectively zero.

Some standards in wireless communication can lengthen the page message times to be longer than one frame. For example, point-to-point message continuation is the process by which the base station sends a message over multiple point-to-point messaging slots. A mobile station responds to point-to-point messaging channel message continuation whenever it determines that a message addressed to its mobile station identification (MSID) number, sent by the base station, occupies more than one point-to-point messaging slot. A page message spanning more than 1 point-to-point messaging slot, when sent on a full-rate digital control channel, is transmitted using every other point-to-point messaging slot. A page message spanning more than 1 point-to-point messaging slot, when sent on a half-rate digital control channel, is transmitted using consecutive point-to-point messaging slots. If a page requiring more than one paging frame or slot is to be received, guard timing will need to be adjusted.

Additional general background, which helps to show the knowledge of those skilled in the art regarding the system context, and of variations and options for implementations, may be found in the following: TIA interim standards IS-136 and IS-54B; and Brodsky, Wireless: The Revolution in Personal Telecommunications (1995); all of which are hereby incorporated by reference.

5

Accepted for filing

Claims

What is claimed is:

- 1 1. A method of evaluating a base station without missing a paging frame,
2 comprising the steps of:
3 receiving a first paging frame from a first base station;
4 initiating a timing sequence after receiving said first paging frame;
5 scanning for system parameters from a second base station; and
6 receiving a second paging frame from said first base station.
- 1 2. The method of Claim 1, further comprising the step of halting said
2 scanning step when said system parameters from said second
3 base station are received.
- 1 3. The method of Claim 1, further comprising the step of halting said
2 scanning step once said timing sequence is complete.
- 1 4. The method of Claim 1, wherein said second paging frame is the paging
2 frame for said mobile station which immediately follows said
3 first paging frame.

1 5. The method of Claim 1, wherein the duration of said scanning step is
2 limited to a predetermined amount of time, said amount of time
3 being dependent on the amount of time between said first and
4 second paging frames.

1 6. The method of Claim 1, wherein the duration of said scanning step is
2 limited to a predetermined amount of time said predetermined
3 amount of time being dependent on mobile station architecture.

1 7. The method of Claim 1, wherein the duration of said scanning step is
2 limited to a predetermined amount of time, said amount of time
3 being dependent on the amount of time required for said mobile
4 phone to switch from said first receiving step to said scanning
5 step and from said scanning step to said second receiving step.

1 8. The method of Claim 1, wherein said steps are performed by a mobile
2 station .

1 9. A method of evaluating a base station without missing a paging frame,
2 comprising the steps of:

3 initiating a timing sequence after receiving a first paging frame from a
4 first base station;

5 selecting a second base station to be evaluated during said timing
6 sequence;

7 scanning said second base station transmissions for system
8 parameters; and

9 receiving a second paging frame from said first base station.

10. The method of Claim 9, further comprising the step of halting said
11 scanning step when said system parameters from said second
12 base station are received.

11. The method of Claim 9, further comprising the step of halting said
12 scanning step once said timing sequence is complete.

12. The method of Claim 9, wherein said second paging frame is the paging
13 frame for said mobile station which immediately follows said
14 first paging frame.

13. The method of Claim 9, wherein the duration of said scanning step is
14 limited to a predetermined amount of time said predetermined
15 amount of time being dependent on mobile station architecture.

1 14.The method of Claim 9, wherein the duration of said scanning step is
2 limited to a predetermined amount of time, said amount of time
3 being dependent on the amount of time between said first and
4 second paging frames.

1 15.The method of Claim 9, wherein the duration of said scanning step is
2 limited to a predetermined amount of time, said amount of time
3 being dependent on the amount of time required for said mobile
4 phone to switch from said first receiving step to said scanning
5 step and from said scanning step to said second receiving step.

1 16.The method of Claim 9, wherein said steps are performed by a mobile
2 station.

1 17.A system of wireless base station and mobile station communication,
2 comprising:
3 first and second base stations transmitting paging frames and system
4 parameters; and
5 a mobile station registered with and receiving paging frames from
6 said first base station;
7 wherein said mobile station evaluates said second base station based
8 on transmitted system parameters of said second base
9 station without missing said paging frames from said
10 first base station.

1 18.The system of Claim 17, wherein said mobile station can receive said
2 system parameters of said second base station only when said
3 first base station is not transmitting said paging frames.

1 19.The system of Claim 17, wherein receipt of a first paging frame triggers
2 evaluation of said second base station.

1 20.The system of Claim 17, wherein said mobile station stops receiving said
2 transmissions of said second base station once said system
3 parameters from said second base station are received.

1 21.The system of Claim 17, wherein said mobile station can receive said
2 transmissions of said second base station only during a
3 predetermined amount of time, said predetermined amount of
4 time being dependent on the architecture of said mobile station.

1 22.The system of Claim 17, wherein said mobile station can receive said
2 transmissions of said second base station only during a
3 predetermined amount of time, said predetermined amount of
4 time being dependent on the amount of time between said
5 paging frames for said mobile station transmitted by said first
6 base station.

1 23.The system of Claim 17, wherein said mobile station can receive said
2 transmissions of said second base station only during a
3 predetermined amount of time, said amount of time being
4 dependent on the amount of time required for said mobile
5 phone to switch from receiving said paging frames transmitted
6 by said first base station to receiving said system parameters
7 transmitted by said second base station and back.

1 24.A mobile station, comprising:
2 a control head;
3 a transceiver unit, comprising
4 a transmitter;
5 a receiver; and
6 a logic control assembly at least partially controlled by said
7 control head; and
8 an antenna assembly connected to said transceiver unit;
9 wherein said logic control assembly controls the operation of said
10 transceiver unit to scan for and evaluate transmitted
11 parameters of at least one base station under evaluation
12 without missing paging frames from a registered base
13 station.

1 25.The mobile station of Claim 24, wherein receipt of a first paging frame
2 from said registered base station triggers said transceiver unit
3 to scan for and evaluate said base station under evaluation.

1 26.The mobile station of Claim 24, wherein said transceiver unit further
2 comprises memory and said logic control assembly executes
3 programs in said memory to scan for and evaluate said
4 transmitted parameters.

1 27.The mobile station of Claim 24, wherein said transceiver unit receives
2 said parameters only when said registered base station is not
3 transmitting said paging frames.

1 28.The mobile station of Claim 24, wherein said transceiver unit stops
2 scanning for said parameters once said parameters are received.

1 29.The mobile station of Claim 24, wherein said transceiver unit can receive
2 said parameters only during a predetermined amount of time
3 said predetermined amount of time being dependent on the
4 architecture of said mobile station.

1 30.The system of Claim 24, wherein said transceiver unit can receive said
2 parameters only during a predetermined amount of time, said
3 amount of time being dependent on the amount of time
4 between said paging frames for said mobile station transmitted
5 by said registered base station.

1 31.The system of Claim 24, wherein said transceiver unit can receive said
2 parameters only during a predetermined amount of time, said
3 amount of time being dependent on the amount of time
4 required for said mobile phone to switch from receiving said
5 paging frames transmitted by said registered base station to
6 receiving said parameters transmitted by said base station under
7 evaluation and back.

ABSTRACT

A method and system of background scanning of an evaluated system by a mobile station without missing paging frames on a registered system. The registered system is defined as the system in which the mobile station has registered and will receive pages. The evaluated system is the system from which the mobile station must retrieve parameters (the possibly higher priority system). The various disclosed embodiments use the periodicity of the paging information to set a guard timer that will force the system back to the registered system before the paging information in the next time slot is missed. After receiving the paging information, the mobile station can continue its search and evaluation of base systems. In other words, the guard timer breaks the background scan into smaller segments that are performed between retrievals of paging information.

Figure 1

(Prior Art)

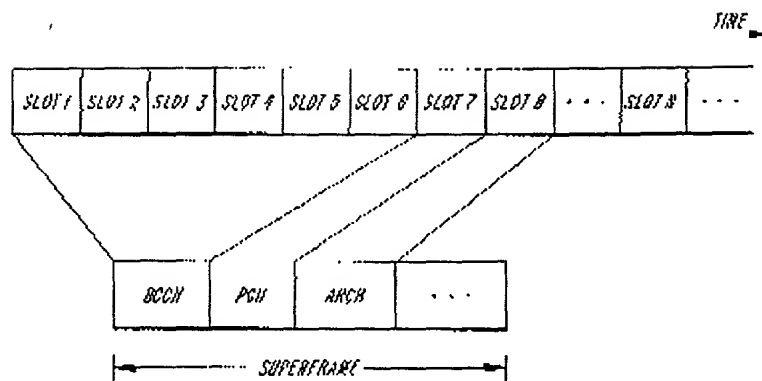


Diagram illustrating the structure of a TDMA frame (40 MS) and its allocation to various channels.

The TDMA frame is divided into two BLOCKS (20 ms each).

The frame structure is detailed as follows:

| SLOT | (6.67 MS) | SLOT | (6.67 MS) | SLOT | (6.67 MS) | SLOT | (6.67 MS) | SLOT | (6.67 MS) | SLOT | (6.67 MS) |
|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|
| 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |

Below the slot table, the frame is mapped to a sequence of slots (0 to 31) and their corresponding channel assignments:

| Slot | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---------|------|---|---|------|---|---|-------|---|---|----------|----|----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Channel | BCCH | | | FBCH | | | SBCCH | | | RESERVED | | | SPACH | | | | | | | | | | | | | | | | | | | |

The entire structure is labeled as a SUPERFRAME (640 MS).

(Prior Art)



Figure 3

662740" 06006260

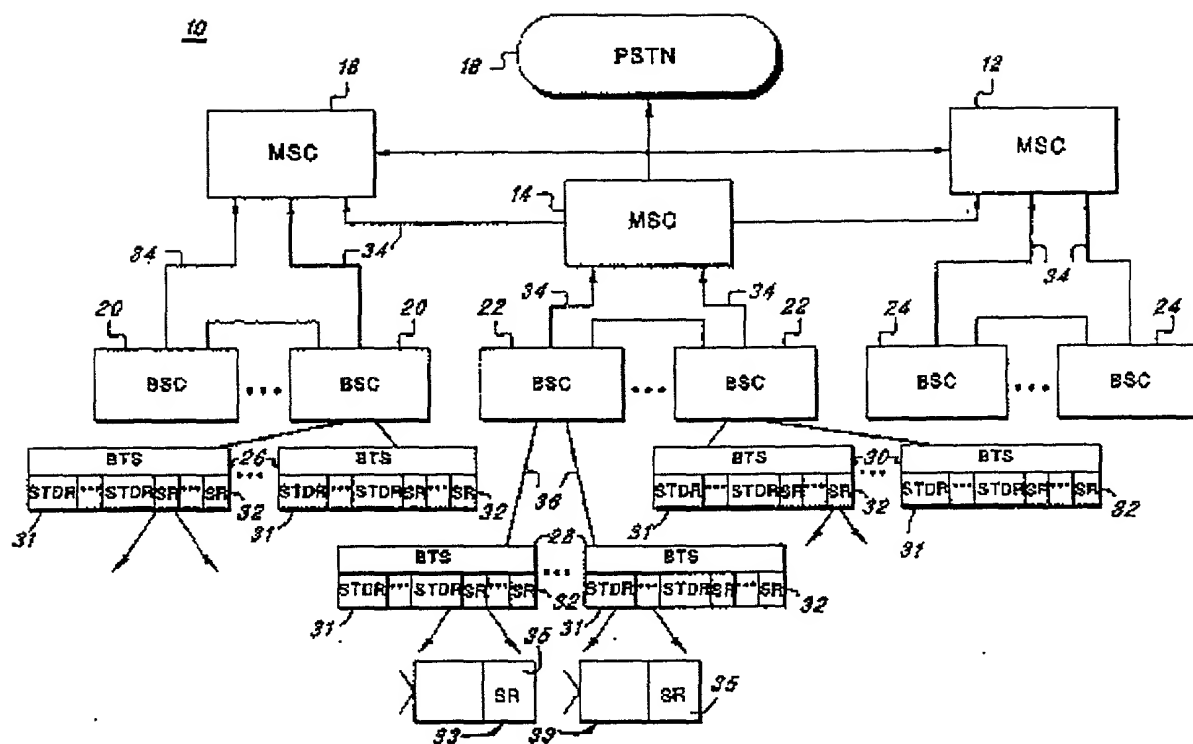


Figure 4

602140 00000000

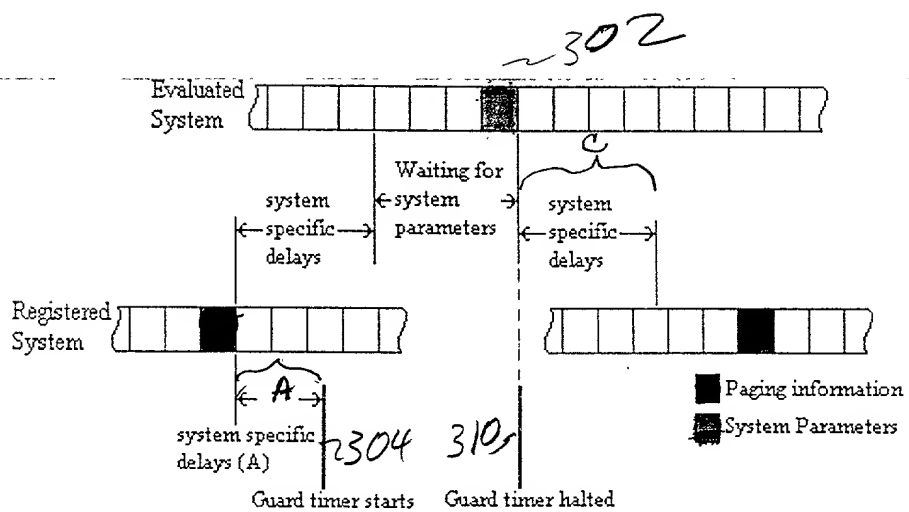


Figure 5

Figure 1 consists of 12 histograms arranged in a 6x2 grid. The columns are labeled 'n=10' and 'n=20'. The rows are labeled 'm=10', 'm=20', 'm=30', 'm=40', 'm=50', and 'm=60'. Each histogram shows the distribution of the number of non-zero elements in the vector x . The x-axis is labeled 'x' and the y-axis is labeled 'count'. The distributions are centered around a value that increases with n and m .

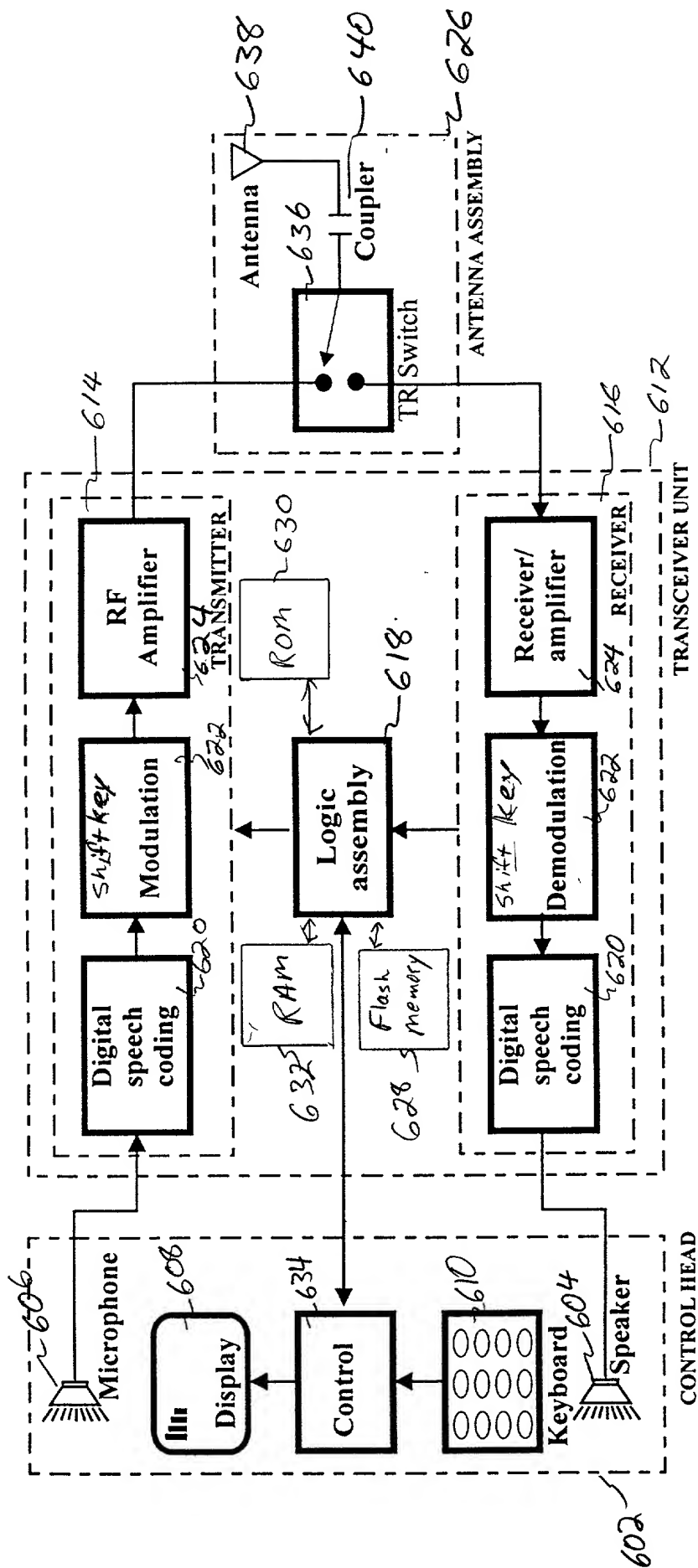


Figure 6

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
☐ design.
☐ supplemental.

NOTE: *If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item, check appropriate one of last three items.*

- ☐ national stage of PCT.

NOTE: *If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.*

- ☐ divisional.
☐ continuation.
☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

SCANNING GUARD TIMER,

SPECIFICATION IDENTIFICATION

the specification of which: [complete (a), (b) or (c)]

- (a) ☒ is attached hereto.
(b) ☐ was filed on _____ as ☐ Serial No. 0 _____/
or ☐ Express Mail No., as Serial No. not yet known
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

- (c) ☐ was described and claimed in PCT International Application No. _____ filed on _____ and
as amended under PCT Article 19 on _____ (if any).

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM [35 U.S.C. § 119(a)-(d)]

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

[complete (d) or (e)]

- (d) ☒ no such applications have been filed.
(e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)–(d)**

| COUNTRY (OR INDICATE IF PCT) | APPLICATION NUMBER | DATE OF FILING (day, month, year) | PRIORITY CLAIMED UNDER 37 USC 119 |
|------------------------------------|-----------------------|--------------------------------------|--|
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
[35 U.S.C. § 119(e)]

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER
Titled "Scanning Guard Timer"
Attorney Docket Number NC-13957P

FILING DATE

3/30/99

CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. 120

- ☐ The claim for the benefit of any such applications is set forth in the attached
ADDED PAGES TO COMBINED DECLARATION AND POWER OF
ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-
PART (C-I-P) APPLICATION.

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: *If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.*

POWER OF ATTORNEY

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registration number)*

| | |
|------------------|--------|
| Brian T. Rivers | 41,270 |
| Robert C. Rolnik | 37,995 |
| Jerry Gnuschke | 42,588 |
| Milan Patel | 41,242 |

(check the following item, if applicable)

- ☐ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO
Nokia Mobile Phones, Inc.
Attn: Brian T. Rivers, Esq.
6000 Connection Drive
Irving, TX 75039

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Brian T. Rivers
(972) 894-4959

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor

Kenneth _____ McClure _____
(GIVEN NAME) (Middle Initial or Name) Family or Last Name

Inventor's Signature: Kenneth A McClure Jr.

Date: April 12, 1999 Country of Citizenship: USA

Residence Irving, Texas, USA
Post Office Address 2616 Laramie Street
Irving, TX 75062

Full name of second joint inventor, if any

(GIVEN NAME) (Middle Initial or Name) Family or Last Name

Inventor's Signature: _____

Date: _____ Country of Citizenship: _____

Residence _____

Post Office Address _____

Full name of third joint inventor, if any

(GIVEN NAME) (Middle Initial or Name) Family or Last Name

Inventor's Signature: _____

Date: _____ Country of Citizenship: _____

Residence _____

Post Office Address _____

*[check proper box(es) for any of the following added page(s)
which form a part of this declaration]*

- ☐ Signature for fourth and subsequent joint inventors. *Number of pages added*
...
- ☐ Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added*
...
- ☐ Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added*
...
- ☐ Added page for signature by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time (37 CFR 1.47). *Number of pages added*
...
- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.
☐ Number of pages added
...
- ☐ Authorization of attorney(s) to accept and follow instructions from representative. *Number of pages added*
...

*(If no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item:)*

☒ This declaration ends with this page.